

PCT/NZ2004/000337 (Amended Claims in Response to Written Opinion of the
International Preliminary Examining Authority). AP20 Rec'd PCT/PTO 06 JUN 2006

CLAIMS:


1. A material discharge apparatus for controlling the discharge of flowable material being conveyed through a conical shaped hopper, the material to be continually discharged through the hopper until in feeding is stopped or ends, the hopper being configured and arranged, in use, to be operable at a height above a surface on which a discharge pile is to be formed, the apparatus including the hopper having an inlet opening adjacent the top and an open discharge outlet at the base of the hopper, the discharge outlet being exposed to the surrounding environment such that, in use, flowable material is discharged through the open discharge outlet, and a valve means being configured and arranged in the hopper, the valve means including a bulb having a lower end portion positionable adjacent the discharge outlet forming a gap between the inner wall of the hopper and the bulb for material, in use, to flow by being gravity fed therebetween and out through the open discharge outlet, the valve means and/or the hopper being adapted to move relative to the other, in use, for controlling the rate of continual discharge through the gap to form a solid column of flowing material to reduce the amount of dust being dispersed into the surrounding environment.
2. A material discharge apparatus according to claim 1 wherein the valve means is arranged in the hopper such that the lower end portion adjacent the discharge outlet is substantially centrally positioned such that the gap between the hopper and the valve means is evenly spaced about the lower end portion of the valve means, and wherein the discharge outlet is not closed by the valve means.
3. A material discharge apparatus according to claim 1 wherein the hopper is adapted to be suspended below a support frame by hopper support members, and wherein the valve means is adapted to be suspended below the support frame.
4. A material discharge apparatus according to claim 3 wherein the hopper is adapted to be suspended below a support frame by a plurality of spaced apart hopper support members, the hopper support members being elastic in form, in use, to expand under

the weight of material being conveyed through the hopper so as to increase the gap between the hopper and the valve means to increase the flow of material therethrough.

- 5 5. A material discharge apparatus according to claim 1 wherein the valve means includes a bulb having a lower end portion having a circular cross section, and wherein the hopper has a circular cross section that is tapered toward the discharge outlet.
- 10 6. A material discharge apparatus according to claim 1 wherein the hopper is adapted to be attached to a support frame and being adapted with a load cell transducer means configured and arranged to measure the weight of the hopper and generate a measurement signal that is forwarded to a valve control means, and a valve height adjustment means configured and arranged for attachment to the valve means and
15 being electrically connected to the valve control means and to receive command signals therefrom, the valve control means being adapted to receive, in use, a measurement signal from the transducer means and control movement of the valve means by the valve control means to raise and lower the valve means to increase or decrease the gap respectively between the hopper and the valve means.
- 20 7. A material discharge apparatus according to claim 6 wherein the valve control means includes a computer controller means programmed by a suitable computer program for controlling the operation of the valve height adjustment means, the controller means allowing a user to enter a preset weight setting for the hopper, and in use, the
25 controller means receives a digital measurement signal from the load cell means representing the weight of the hopper with material, and when the weight signal exceeds the threshold preset weight setting the controller means actuates the valve height adjustment means to raise the valve means to increase the gap and allow a higher discharge rate of material until the weight measurement signal from the load
30 cell means falls below the preset weight setting.

8. A material discharge apparatus according to claim 6 wherein the controller means actuates the valve height adjustment means to raise the valve means in predetermined incremental lift positions.
- 5 9. A material discharge apparatus according to claim 1 wherein the hopper is made of a rotary moulded plastics material.
10. A material discharge apparatus according to claim 3 wherein the hopper support members include coil springs, in use, that are expandable under the weight of lading in the hopper.
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11. A computer controlled process for controlling the flow rate of material conveyed through a hopper, the computer program including the steps of:
- 15 a. receiving a measurement signal from a load cell transducer means representing an actual measurement of weight of a hopper with material flowing therethrough and comparing the measurement against a preset measurement of weight representing a preferred flow rate through the hopper;
- b. if the actual measurement of weight is more than the preset measurement of weight a control signal is sent to a valve height adjustment means to lift a valve means in the hopper to increase the discharge rate of material flowing through the hopper;
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- c. if the actual measurement of weight is less than the preset measurement of weight a control signal is sent to the valve height adjustment means to lower the valve means in the hopper to decrease the discharge rate of material flowing through the hopper; and
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- d. resetting the program to repeat step a until the material has been discharged through the hopper.

12. A computer controlled process according to claim 11 wherein in step a. the program allows an operator to preset the number of measurements per minute taken by the load cell transducer means.
- 5 13. A computer controlled process according to claim 11 wherein in step a. if the actual measurement of weight is determined by the program to be the same as the preset measurement of weight the program will reset to step a.
14. A computer controlled process according to claim 11 using the apparatus of claim 6.
- 10 15. A method of controlling the flow rate of material conveyed through a hopper, the steps of the method including:
- 15 A. Comparing an actual measurement of weight of a hopper with material flowing therethrough with a preset measurement of weight representing a preferred flow rate through the hopper;
- B. if the actual measurement of weight is more than the preset measurement of weight, the valve means in the hopper is actuated to rise to increase the discharge rate of material flowing through the hopper;
- 20 C. if the actual measurement of weight is less than the preset measurement of weight the valve means in the hopper is actuated to lower the valve means in the hopper to decrease the discharge rate of material flowing through the hopper; and
- D. repeating step a until the material has been discharged through the hopper.
- 25 16. A material discharge apparatus according to claim 1 wherein the bulb includes a conical lower end portion, and a conical top portion with a circular cross section being tapered toward the top end portion forming an inverted cone on the lower end portion, the conical lower end portion being tapered toward the lower end of the bulb.
- 30 17. A material discharge apparatus substantially as herein described with reference to any one of the accompanying drawings.

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18. A computer controlled process according to claim 11 substantially as herein described.
 - 5 19. A method of controlling the flow rate of material conveyed through a hopper according to claim 15 substantially as herein described.